

## **Report for 2005DE54B: Hydrogeology of the Near-Surface Aquifers in Sussex County**

### **Publications**

- Water Resources Research Institute Reports:
  - Andres, A. Scott, Bailey Dugan, and Andrew Klingbeil, 2006, Hydrogeology of the Near-Surface Aquifers in Sussex County, Delaware Water Resources Center, University of Delaware, Newark, Delaware, 29 pages.
- Other Publications:
  - Boyd, Amy, ed., 2005, Delaware Water Resources Center WATER NEWS Vol. 6 Issue 1 "DWRC Announces New Undergraduate Interns for 2005 – 2006", <http://ag.udel.edu/dwrc/newsletters/Summer2005.pdf>, p. 4-5.

### **Report Follows**

## **Undergraduate Internship Project #2 of 17 for FY05**

*DWRC* and the *Delaware Geological Survey (DGS)* co-sponsored **Bailey Dugan's** internship evaluating the "*Hydrogeology of the Unconfined Aquifer in Sussex County*". Domestic water use by approximately two-thirds of Delaware's population, water use for self-supplied industry, and water for most of agriculture, Delaware's largest industry, is derived from groundwater sources. Bailey investigated aspects of groundwater found in shallow aquifers susceptible to pollution. Her advisors were A. Scott Andres and Andrew Klingbeil of the *DGS*.



*"I gained experience in field work and research and learned to compile and interpret large amounts of data through the creation of spreadsheets, contour maps, and cross-sections and the use of Geographic Information Systems."*  
– Bailey Dugan

### **Abstract**

Groundwater, which is in aquifers below the surface of the Earth, is one of the nation's most important natural resources; it is the source of all fresh water used for potable, industrial, commercial, and irrigation purposes in Sussex County, Delaware. The Columbia Aquifer represents the shallowest aquifer of Delaware's groundwater resource. The unconfined portion of the Columbia Aquifer is important in that it supplies water to many agricultural, domestic, industrial, public, and irrigation wells. In some regions, deeper aquifers are in direct contact with the unconfined Columbia Aquifer, and therefore function as part of the unconfined aquifer as well. Detailed information concerning the thickness and water-transmitting (transmissivity) characteristics of the unconfined aquifer is important in the management of the water contained within it.

The identification and description of the geologic units hosting the unconfined aquifer is important in predicting the distribution and water-bearing characteristics of the aquifer, which is necessary information for proper water-use management. The geologic units of importance for examination of the near-surface hydrogeologic framework in Sussex County include the Calvert, Choptank, St. Marys, Cat Hill, Bethany, and Beaverdam Formations, and the Nanticoke, and Delaware Bay Group deposits.

Records obtained from the DGS and the DNREC of descriptive and geophysical logs of drillholes and boreholes throughout Sussex County were examined to produce two cross-sections (one running north to south, one running east to west) and three structure contour maps (illustrating elevations of different formations) to show general characteristics and trends of the county's hydrogeologic framework. Three logs were examined more closely to show more specific details on lithology, gamma log signatures, and thickness of each identified formation and aquifer; transmissivity was also calculated for each of the three logs using a hydraulic conductivity equation.

The boreholes examined in this study possessed a large variation in aquifer thickness. The St. Marys Formation and all overlying units were each found to contain confining beds within the study region. The unconfined aquifer was therefore found to fluctuate highly in thickness and content; sediments contained within the Cat Hill, Bethany, and Beaverdam Formations and the Nanticoke and Delaware Bay Group deposits were found to function as part of the unconfined aquifer in various locations in Sussex County. Of the 23 boreholes used in the 3 cross-sections, the unconfined aquifer was found to range in thickness from 12 to 223 feet. The transmissivity of the unconfined aquifer was also found to be highly variable, ranging from 8,770 to 14,300 feet squared per day; this range shows the inconsistency in thickness and composition of the sediments forming the unconfined aquifer. The variability of these aquifer properties makes it difficult to predict and define thickness and transmissivity without extensive and accurate data.

This study has shown the complexity and variability of the near-surface hydrogeology in Sussex County; it has developed a framework for further definition and better management of Delaware's groundwater resource.